REPORT

OF

THE DIRECTOR

OF THE

ROYAL OBSERVATORY, HONGKONG,

FOR THE YEAR

1920

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REPORT OF THE DIRECTOR OF THE ROYAL OBSERVATORY, HONGKONG, FOR THE YEAR 1920.

I.—Grounds and Buildings.

The grounds were kept in order by the Botanical and Forestry Department with the assistance of the Observatory coolies.

Concreting the paths round the servants quarters was completed in the month of October.

II.—Meteorological Instruments.

Barometers.—A Marvin compensated syphon barometer was received on July 3. The tube was satisfactorily filled with mercury, but unfortunately it was broken in fitting it to its U tube and support. Two new tubes were ordered in August but have not yet been received.

Beckley Anemograph.—This instrument was oiled once a month, and the orientation of the head checked.

Dines-Baxendell Anemograph.—The head was oiled once a month, and the spindle of the float cleaned and oiled once a week. The orientation of the head was checked monthly.

The mean monthly results of comparisons with the records of the Beckley Anemograph from 1910-1919 are given in the following table, together with the results for 1920:—

Factor for converting the actual run of the Beckley Anemograph cups to velocities recorded by the Dines Pressure Tube Anemograph.

Month.	Factor (Dines $\div \frac{\text{Beckley}}{3}$).	
	Mean 1910-1919.	1920.
January,	2·10	1·67
February,	2·15	1·70
March,	2·17	1·67
April,	2·16	1·77
May,	2·19	1·98
June,	2·18	2·40
July,	2·29	2·09
August,	2·29	1·58
September,	2·29	1·53
October,	2·22	1·43
November,	2·14	1·36
December,	2·07	1·50
Year,	2·19	1·72

The scale value of the Dines-Baxendell instrument was determined in the month of May, 1918, by means of a gauge constructed at the Observatory. It appeared to be correct within the probable error of observation, which was about 1 mile at a velocity of 80 m.p.h. increasing to 3 miles at 10 m.p.h.

Gap Rock Anemograph.—In the month of July a Dines-Baxendell anemograph was erected at Gap Rock. The records indicate defects in the instrument which it is hoped it will be possible to remedy shortly.

Thermometers.—All thermometers in use were compared with the Kew Standard in winter and summer.

Richard Thermograph.—The base lines laid down on the Richard thermograms from the hourly readings of dry and wet bulb rotating thermometers show irregularities which it is difficult to attribute to the exposure, the thermograph being placed in a well ventilated double-thatched shed, 25 feet long by 20 feet wide, with gabled roof sloping from a height of 9 feet at the ridgepole to $3\frac{1}{2}$ feet at the eaves.

The thermograph is aspirated by a 12-inch fan distant $2\frac{1}{2}$ feet, which draws in the external air through a 14 inch pipe. The fan is operated by a contact on one of the electric dials closed from the 58th to the 60th minute of each hour. Prior to 1920, January 5, the contact was closed from the 59th to the 60th minute only, but it was found that one minute was not sufficient ; on occasions the wet bulb pen was still falling at the 60th minute.

The registers are time-scaled electrically. An electro-magnet, operated by the hourly time signal, lifts the pens from the paper and clock work apparatus, adapted by Mr Evans in January, locks them until the 3rd minute when they are released and fall back on to the paper.

Sunshine Recorder.—In view of the interruption to the sunshine records caused by the Observatory wireless mast, a new sunshine recorder was obtained from Messrs J. Hicks and mounted on the south-west corner of the Main Building on January 6, 1921. Its records furnish the necessary corrections to those of the old instrument.

Peak Anemograph.—Signalman Osborne was in charge of this instrument from March 9 until May 31 when he resigned on account of ill health. He was replaced by Signalman McGrann on June 28. In the interval the sheets were changed daily by a computer from the Observatory.

It has not been possible to send an European Assistant to inspect the instrument as often as necessary, with result that the records have not always been satisfactory.

It is hoped that the meteorological observations at the Peak Signal Station, to which reference was made in last year's report, will be commenced shortly.

III.—Meteorological Observations at the Observatory.

Automatic records of the temperature of the air and evaporation were obtained with a Richard dry and wet bulb thermograph, and of the direction and velocity of the wind with a Beckley and a Dines-Baxendell anemograph, modified as described in the report for 1912. The amount of rain is recorded automatically by a Nakamura pluviograph, the amount of sunshine by a Campbell-Stokes universal sunshine recorder, and the relative humidity of the air by a small Richard hair hygrograph. Eye observations of barometric pressure, temperature of the air and of evaporation and the amount of cloud are made at each hour of HongKong Standard time. The character and direction of the motion of the clouds are observed every three hours. Daily readings are taken of self-registering maximum and minimum thermometers.

Principal Features of the Weather.—The principal features of the weather in 1920 were:—

(*a*) Barometric pressure below normal from the beginning of May to the beginning of August.

(*b*) Rainfall much above normal in May, July and November.

Barometric pressure was considerably below normal in May, June, July, November and December and moderately above in January. The mean pressure for the year at station level was $29^{ins.}\cdot814$ as against $29^{ins.}\cdot842$ in 1919 and $29^{ins.}\cdot843$ for the past 37 years. The highest pressure was $30^{ins.}\cdot374$ on January 4th as against $30^{ins.}\cdot398$ in 1919 and $30^{ins.}\cdot509$ for the past 37 years. The lowest pressure was $29^{ins.}\cdot208$ on July 19th as against $29^{ins.}\cdot287$ in 1919 and $28^{ins.}\cdot735$ for the past 37 years.

The temperature of the air was moderately below normal in April and considerably above normal in November and December. The mean temperature for the year was $72^{\circ}\cdot0$ as against $72^{\circ}\cdot2$ in 1919 and $71^{\circ}\cdot8$ for the past 37 years. The highest temperature was $93^{\circ}\cdot1$ on July 25th as against $92^{\circ}\cdot2$ in 1919 and $97^{\circ}\cdot0$ for the past 37 years. The lowest temperature was $45^{\circ}\cdot1$ on January 5th as against $39^{\circ}\cdot4$ in 1919 and $32^{\circ}\cdot0$ for the past 37 years.

The rainfall was considerably above normal in May, July and November. The total for the year was $107^{ins.}\cdot880$ as against $76^{ins.}\cdot140$ in 1919, and $84^{ins.}\cdot276$ for the past 37 years. The greatest fall in one civil day was $8^{ins.}\cdot235$ on July 19th and the greatest in one hour was $1^{ins.}\cdot435$ between 8.30 p.m. and 9.30 p.m. on September 12th.

The wind velocity was considerably below normal in January and October and moderately below in February, June and September. It was moderately above normal in May and July. The mean velocity for the year was 12·0 m.p.h. as against 11·4 m.p.h. in 1919 and 12·7 m.p.h. for the past 37 years. The maximum velocity for one hour, as recorded by the Beckley Anemograph, was 51 miles at 2 a.m. on July 31st as against 60 miles in 1919 and 103 for the past 37 years. The maximum squall velocity, as recorded by the Dines-Baxendell Anemograph, was at the rate of 61 m.p.h. at 10*h.* 58*m.* p.m. on July 30th as against 84 m.p.h. in 1919 and 105 m.p.h. for the past 11 years.

Rainfall at Four Stations.—In the following table the monthly rainfall for the year 1920 at the Observatory is compared with the fall at the Police Station, Taipo, the Botanical Gardens, and the Matilda Hospital, Mount Kellet :—

Months.	Observatory (*Kowloon*).	Police Station (*Taipo*).	Botanical Gardens (*Hongkong*).	Matilda Hospital (*Hongkong*).
	inches.	*inches.*	*inches.*	*inches.*
January, ...	0·065	0·11	.....	0·04
February, ...	2·640	5·44	3·10	2·66
March, ...	1·390	2·15	1·50	1·20
April, ...	8·265	7·03	7·88	7·43
May, ...	18·155	13·44	17·68	14·44
June, ...	15·535	18·82	17·90	13·78
July, ...	24·040	24·55	27·28	20·65
August, ...	10·975	28·35	14·74	8·93
September,...	11·750	7·90	17·22	12·40
October, ...	6·190	4·68	8·66	8·11
November, ...	7·045	7·50	7·16	7·78
December, ...	1.810	0·59	0·92	0·55
Year,...	107·880	120·56	124·04	97·97

Floods.—The heaviest rainfall occurred at the Observatory as follows :—

Period.				*Amount.*		*Duration.*		*Greatest fall in 1 hour.*	*Time.*	
	d.	h.			d.	h.	inches.	hours.	inches.	d. h.
May.....	28	4	to	June...	2	16	10·330	76	1·17	May.....28 13
June ...	9	9	to	June...	12	18	10·.00	43	1·20	June ...12 8
July.....	18	7	to	July...	21	2	12·695	49	1·12	July.....19 10
July.....	30	16	to	Aug....	4	7	8·275	31	1·01	July.....31 16
Sept.....	10	22	to	Sept...	13	14	8·420	36	1·43	Sept.....12 21
Nov.....	17	8	to	Nov....	18	9	4·860	19	0·64	Nov.....17 17

Typhoons.—The tracks of 16 typhoons and 4 of the principal depressions which occurred in the Far East in 1920 are given in two plates in the Monthly Meteorological Bulletin for December, 1920. The most noteworthy, as affecting Hongkong, were those of July 10-23 and July 29-31. The former apparently formed to the east of Luzon on July 10th, moved slowly NNW till the 13th, then more rapidly in a northerly direction until the 15th when it curved to westward and entered the coast near Wenchow on the morning of the 16th. It finally filled up in the Gulf of Tong King on the 23rd. Strong SW winds occurred at Hongkong from the 16th to 19th.

This storm was remarkable as being the only typhoon to enter the Eastern Sea in 1920, and for its long duration over the land.

The typhoon of July 29-31 formed in about latitude 17° N and longitude 115° E. Moving in a NNW direction it entered the coast about 70 miles to the west of Macao at about noon on the 31st. It caused a strong easterly gale at Hongkong.

A violent typhoon, of small diameter and abnormal track, formed to the west of Manila in the forenoon of August 31 and passed a few miles to the north of the Manila Observatory between 7 and 8 p.m. For the track of this typhoon I am indebted to the courtesy of the Director of the Philippines Weather Bureau, who states that it was the worst typhoon experienced in Manila since September, 1905.

IV.—Publications.

Daily Weather Report and Map.—A weather map of the Far East for 6 a.m. of the 120th meridian, and the Daily Weather Report (containing meteorological observations, usually at 6*h.* and 14*h.*, from about 40 stations in China, Indo-China, Japan, the Philippines, and Borneo) and daily weather forecasts for Hongkong to Gap Rock, the Formosa Channel, the south coast of China between Hongkong and Lamocks, and between Hongkong and Hainan, were issued as in former years. Copies of the map were exhibited on notice boards at the Hongkong Ferry Piers, Blake Pier, and the Harbour Office. One copy was sent daily to the Director of the Meteorological Observatory, Macao. Forty copies of the Daily Weather Report were distributed to various offices, etc., in the Colony, and a copy was sent daily to the Director of the Meteorological Observatory, Macao. Copies were sent every week to the Hydrographic Office, Bangkok.

A charge of $10 a year is made for supplying private firms and individuals with the Daily Weather Report, and $36 for the Weather Map. No maps were published on February 1, 4, March 7, 10, 13, April 15, 18, June 6, 8, July 18, September 5, and October 10, owing to the late arrival of the weather telegrams. On many other occasions the map, though published, contained but meagre information.

The weather forecast is telegraphed daily to the Cape d'Aguilar Wireless Station in time for distribution at 1 p.m. It is broadcasted again at 5 p.m.

Monthly Meteorological Bulletin.—The Monthly Meteorological Bulletin, which includes the Daily Weather Report, was published as usual, and distributed to the principal observatories and scientific institutions in different parts of the world.

Miscellaneous Returns.—A monthly abstract of observations made at the Observatory is published in the Government *Gazette*, and daily, monthly, and yearly results are published in the Blue Book in the form suggested by the London Meteorological Office for the British Colonies.

The monthly departures from normal of the barometric pressure at four China Coast Ports are communicated to the Commonwealth Meteorologist, Melbourne, in connection with long range weather forecasts. Monthly meteorological returns are forwarded to the Meteorological Magazine, and annual returns to the Stock Exchange Official Intelligence, and the Colonial Office List.

V.—Weather Telegrams, Forecasts, and Storm Warnings.

Daily Weather Telegrams.—In the month of June representations were made to the Superintendent of the Eastern Extension Telegraph Co. on the subject of delays in the transmission of daily weather telegrams. Mr Airey took up the matter energetically, with the result that now observations from the Philippines are received in time for insertion in the Daily Weather Map. The Vladivostock and Indo-China observations also arrive in time fairly regularly, and the Japanese observations occasionally.

Occasionally belated weather telegrams are received from Central and South China, but as a rule the observations from these districts are posted in batches to Hongkong.

Extra Weather Telegrams.—The following stations send extra weather telegrams at half rates during typhoons, on receipt of certain code words from Hongkong :—Amoy, Canton, Macao, Phulien, Sharp Peak, and Taihoku. The Director of the Philippines Weather Bureau also sends extra telegrams, at his discretion, from Aparri or some other station nearer the typhoon centre.

The extra 9 p.m. telegram, from Swatow, kindly sanctioned by the Chinese Telegraph Administration during the typhoon season, was frequently not received.

Wireless Weather Telegrams.—There has been but a poor response to the Marconi Company's circular and the Observatory Notice to Mariners respecting wireless weather telegrams referred to in last year's report.

The following table gives the monthly number of ships, of different nationalities, from which wireless meteorological messages have been received, and the number of messages received, (each arrival and departure is counted separately).

Month.	*British (including H.M. Ships).*		*Dutch.*		*Japanese.*		*Other National ties.*	
	No. of ships.	No. of messages.	No. of ships.	No. of messages.	No. of ships.	No. of messages.	No. of ships.	No. of messages.
January, ...	4	11	2	3	...	...	...	...
February, ...	6	11	5	6	...	...	...	...
March, ...	3	6	3	4	...	...	1	1
April,.....	2	4	4	5	3	7	1	1
May, ...	3	6	2	3	1	1	...	...
June,.....	7	10	7	11	2	3	1	1
July, ...	12	17	7	14	5	6	...	...
August,.....	7	10	3	5	1	1	...	...
September, ...	4	8	5	10	3	6	...	...
October,.....	6	7	5	8	5	10	...	...
November,.....	5	8	1	2	2	5	...	...
December,.....	5	6	4	5	3	6	...	...
Totals 1920,...	64	...	48	...	25	...	3	...
Totals 1919,...	17	...	36	...	6	...	2	...
Totals 1918,...	...	...	41	...	14	...	...	...
Totals 1917,...	...	...	93	...	37	...	...	...
Totals 1916,...	...	...	95	...	60	...	...	...

Results of Weather Forecasts.—The results of the comparison of the daily weather forecasts with the weather subsequently experienced are given below, with the results of the previous five years:—

Year.	Complete Success.	Partial Success.	Partial Failure.	Total Failure.
	%	%	%	%
1915	54	37	8	1
1916	67	29	3	1
1917	67	29	4	0
1918	71	26	3	0
1919	71	27	2	0
1920	64	30	5	1

No forecasts were issued on February 4 and March 13, owing to lack of telegraphic information.

The forecast comprises wind direction, wind force, and weather.

Complete success means correct in three elements. Partial success means correct in only two elements. Partial failure means correct in only one element. Total failure means correct in no element.

The method of analysis is described in the 1918 Report.

Storm Warnings.—At the request of the Chamber of Commerce the Hongkong government adopted the China Seas Storm Signal Code from 1920, June 1, in place of the Hongkong Non-Local Code introduced in 1917.

The following Ports are warned by a telegraphic adaptation of this code :—Sharp Peak, Swatow, Amoy, Santuao, Macao, Canton, Wuchow, Pakhoi, Hoihow, Phulien, Taihoku, Manila, Labuan, and Singapore.

As the China Seas Code includes a time signal at the mast head which formerly was reserved for the Local Typhoon Signals, it became necessary to select a new site for the Local Signals.

A Committee composed of the Colonial Secretary, the Harbour Master, the Director of the Observatory, the President of the Chamber of Commerce and representatives of Messrs. Jardine, Matheson & Co., Ltd. and Messrs. Butterfield & Swire was therefore appointed by His Excellency the Governor to consider the matter. At the suggestion of the Director of the Observatory the Committee recommended that the Local Typhoon Signals should be transferred to the Observatory wireless mast. This was approved and the necessary gibbet and hoisting gear were installed by the Public Works Department. The Old Equatorial Dome was enlarged to accommodate the Local Typhoon symbols.

As the Observatory is farther from the town than the Signal Hill the height of the symbols was increased to 8 feet and the other dimensions increased in proportion.

The local day signals are repeated at the Harbour Office, H.M.S. *Tamar*, Green Island, the Godown Company (Kowloon), Lyemun, and Lai Chi Kok.

The local night signals are exhibited on the Observatory Wireless Mast and repeated on the tower of the Kowloon Railway Station, on H.M.S. *Tamar*, and at the Harbour Office.

A translation of the non-local and local storm warnings is exhibited at the Harbour Office, the General Post Office and the Star Ferry Piers and also sent to the Cape d'Aguilar Wireless station

which broadcasts the message at about noon and repeats it every two hours until midnight. If a second warning is issued during the day, the later warning is substituted.

When a local storm warning is displayed at the Observatory a cone is exhibited at several outlying stations for the benefit of native craft and passing ocean vessels.

In the following table is given the number of hours the local signals were hoisted in each of the years 1912-1920:—

Year.	Red Signals.	Black Signals.	Bombs. *
	Number of hours hoisted.		Number of times fired.
1912	151	164	...
1913	146	189	1
1914	146	178	...
1915	64	120	...
1916	70	201	1
1917	102	36	...
1918	33	102	1
1919	78	105	1
1920	107	136	...

The figures in the above table included the number of hours that night signals, corresponding to the day signals, were hoisted.

The red signals indicate that a depression exists which may cause a gale at Hongkong within 24 hours. The black signals indicate that a gale is expected at Hongkong.

Prior to July, 1917, the red signals indicated that the centre of the typhoon was believed to be more than 300 miles distant, and the black less than 300 miles; the returns for 1912-1916 are therefore not strictly comparable with those for 1917-1920.

VI.—Meteorological Observations from Ships.

Treaty Ports, &c.

Logs received.—In addition to meteorological registers kept at about 40 stations in China, meteorological logs were received from 170 ships operating in the Far East. These logs, representing 5,872 days' observations, have been utilised for verifying typhoon tracks. The corresponding figures for the years 1919 were 81 and 2,587.

* Three bombs fired at intervals of 10 seconds indicate that wind of typhoon force is anticipated.

Comparison of Barometers.—During the year 170 comparisons of ships' barometer have been made by means of observations taken when in harbour. Several direct comparisons of barometers for shipmasters and various persons in the Colony have been made at the Observatory.

VII.—Magnetic Observations.

The mean values of the magnetic elements for the years 1919 and 1920 were as follows:—

	1919.	*1920.*
	° ′ ″	° ′ ″
Declination (west)	0 19 50	0 20 45
Dip (north)	30 47 30	30 46 22
Horizontal Force (C. G. S. unit)	0·37171	0·37191
Vertical Force (C. G. S. unit)..	0·22151	0·22146
Total Force (C. G. S. unit) ...	0·43270	0·43286

The series of magnetic observations made in the old magnetic hut since 1884 terminated in December, the site having been taken over by Government for European Assistants' Quarters. Observations in the new hut cannot be made until the building operations are finished.

Comparisons between Magnetometers Elliott 55 and 83 and Dip Circle Dover 71, in the old and new huts, were made between 1919 August and 1920 June, as opportunity offered.

The mean results of the observations are given below:—

Horizontal Force.

Elliott 55 and vibration magnet 55A in old hut. (*a*).	Elliott 83 and vibration magnet 83 in new hut. (*b*).	(*a*)—(*b*).	Number of observations.
0·37162	0·37216	− 0·00054	18

Elliott 55 and vibration magnet 55A. in old hut. (*a*).	in new hut. (*b*).		
0·37201	0·37200	+ 0·00001	5

7 Comparisons made in the year 1916 in the old hut gave:—

Elliott 55 and vibration magnet 55A. − Elliott 83 and vibration magnet 83. = + 22 γ

It should be mentioned that prior to the comparisons in 1919-1920 the lens and scale of magnet 83 were transposed, for convenience of observing. The lens was originally at the north end of the magnet.

After this alteration the value of log $\pi^2 K$ at 0°c was found to be 3·44611 ± ·00004 as against 3·44643 determined at Kew in 1915 and used in the 1916 comparisons. The value of P from the 18 observations in 1919-1920 was + 7·58 ± ·07; whereas the value used in 1916, as derived from 7 observations was + 7·78 ± ·08.

Declination.

Elliott 55 and vibration magnet 55A in old hut. (a)	Elliott 83 and vibration magnet 83 in new hut. (b)	(a)—(b)	Number of observations.
20′ 6″ W.	19′ 36″	+ 30″	22

Elliott 83 and vibration magnet 83 in old hut. (a)	Elliott 55 and vibration magnet 55A in new hut. (b)		
20′ 22″ W.	20′ 54″	− 32″	6

Dip.

Dover 71 in old hut. (a)	Dover 71 in new hut. (b)		
30° 46′ 48″ N.	30° 47′ 75″ N.	−1′ 27	16

VIII.—Time Service.

Time Ball.—Prior to 1920, January 1, the Time Ball on Kowloon Signal Hill was dropped daily at 1 p.m. (120th Meridian Time). It is now dropped at 10 a.m. and 4 p.m. daily, except on Saturdays when it is dropped at 10 a.m. and 1 p.m., and on Sundays and Holidays when it is dropped at 10 a.m. only.

The Ball is hoisted half mast at the 55th minute and full mast at the 57th minute. If the ball fails to drop at the correct time it is lowered at 5 minutes past the hour and the ordinary routine repeated at the following hour, if possible.

When the Time Ball is out of order the above routine is carried out with the flag "z", on the Storm Signal mast.

Time Signals are also given at night by means of three white lamps mounted vertically on the Observatory wireless mast. From 8*h*. 56*m*. 0*s*. to 9*h*. 0*m*. 0*s*. p.m. the lamps are extinguished momentarily at the even seconds, except at the 2nd, 28th, 50th, 52nd, and 54th of each minute. The hours refer to Hongkong Standard Time (8 hours East of Greenwich).

The ball was dropped successfully 651 times. There were 6 failures attributable to electrical and mechanical defects or to the negligence of the computers in charge at the tower. The days on which the ball failed to drop were:—February 19, March 9, April 26, May 16 and September 20 (twice).

The ball was not raised on January 18 (10*h*), February 18 (10*h*), March 12 (10*h*), May 19 (10*h*), July 30 (16*h*), 31 (10*h* & 16*h*), and September 27 (10*h*), owing to repairs, or the prevalence of high winds.

The ball fell with an error of 0·3 sec. or less on 562 occasions, and with an error of 0·4 sec. or 0·5 sec. on 76 occasions. Errors of 0·6 sec. occurred 10 times, of 0·9, 1·0 and 1·5 sec. once each. The mean probable error of the Time Ball was ± 0·18 sec. The monthly values for the past 5 years are given below :—

Month.	Probable Error of the Time Ball.				
	1916	1917	1918	1919	1920
January,	±0·15	±0·17	±0·11	±0·24	±0·17
February,	·28	·10	·13	·20	·30
March,	·17	·11	·15	·12	·21
April,	·18	·18	·10	·19	·15
May,	·10	·17	·12	·14	·17
June,	·17	·10	·14	·14	·13
July,	·10	·21	·11	·13	·22
August,	·10	·11	·26	·15	·11
September,	·11	·10	·16	·10	·24
October,	·13	·10	·12	·15	·15
November,	·13	·10	·12	·14	·19
December,	·11	·10	·14	·12	·13
Means,	±0·14	±0·13	±0·14	±0·15	±0·18

Time Signals by Wireless Telegraphy.—In addition to the time signals given by the Time Ball, signals are sent at noon and at 21*h*. by wireless telegraphy *viâ* Cape d'Aguilar. Particulars of the programme are given in the 1918 Report. The service has been interrupted rather frequently by circumstances over which the Observatory has no control. It is to be transferred to Stonecutters when the necessary cable between this Station and the Observatory is laid.

Wireless Receiving Set.—A receiving set was installed at the Observatory by the Naval Authorities in November, and wireless Time Signals have since been regularly observed from Manila and Funabashi (Tokio), though the observations have frequently been spoilt by other stations working, in contravention of paragraph 3 of Article 45 of the Service Regulations appended to the International Radiotelegraph Convention of 1912. The Shanghai signals are still not heard.

It is hoped that the Director may soon have an opportunity of discussing details of a uniform scheme of Wireless Time Signals with the Directors of other Observatories in the Far East.

Transit Instrument.—Observations for time were made daily with the 3 inch transit instrument and the Hipp tape chronograph by the Chinese computers, weather permitting.

The number of observations in the years 1919 and 1920 were as follows :—

	1919	1920
Transits,	3,324	985
Level determinations,	676	537
Azimuth,	23	20
Collimation, ...	22	20

Transits of the Sun were utilized occasionally during 1920.

The azimuth and collimation determinations were made by the Chief and First Assistants from observations of the old south mark.

Clocks.—The losing rate of the Standard Sidereal clock, Dent No. 39741, varied from −0·23 sec. on July 9 (Barometer 28·63 Temperature 84·3) to −0·76 sec. on November 11 (Barometer 29·82 Temperature 78°·3).

The rate during cloudy periods was usually derived from the formula :—

$r = -0^s.792 + 0^s.575\,[b-29in.] - 0^s.00021\,[t-50°]$ where r is the computed losing rate, and b and t the mean barometric pressure and temperature, respectively, for the preceding 24 hours.

In the following table is given the excess of the observed over the computed error after cloudy periods during 1920 :—

Date 1920.	Interval without observations.	Excess of observed over computed error.
		secs.
February 16, ...	22 days	+ 1·01
March 18, ...	30 „	− 0·24
„ 24, ...	6 „	+ 0·25
April 2, ...	9 „	− 0·32
„ 16, ...	12 „	+ 0·31
May 14, ...	18 „	+ 0·53
June 2, ...	7 „	+ 0·51
„ 16, ...	6 „	− 0·29
„ 27, ...	5 „	− 0·26
July 5, ...	4 „	+ 0·49
„ 23, ...	6 „	− 0·42
August 6, ...	5 „	+ 0·35
„ 12, ...	4 „	+ 0·12
„ 20, ...	4 „	− 0·05
September 1, ...	5 „	+ 0·34
„ 14, ...	5 „	− 0·19
„ 24, ...	5 „	− 0·43
October 9, ...	4 „	− 0·11
November 8, ...	4 „	− 0·[illegible]
December 2, ...	4 „	− 0·43
„ 3, ...	5 „	− 0·[illegible]

The clock tripped two seconds on September 15. It was cleaned and the contact springs re-adjusted on September 24.

The Dent Mean Time clock (No. 39749) was used throughout the year for dropping the Time Ball, maintaining the electric time service in the Observatory, and sending hourly signals to the Railway, the Post Office, the Telephone Co., and the Eastern Extension Telegraph Co. The clock is corrected daily before 10 a.m. by the electric regulating apparatus, and its daily rate kept below 0·5 sec. by the addition or removal of weights from the pendulum.

Chronometer Dent No. 40917 is on loan to the Cape d'Aguilar Wireless Station, and chronometer Dent No. 39946 to the Peak Signal Station. Chronometer Woolf No. 5232 was forwarded for safekeeping to the Observatory by the Hon. Colonial Treasurer in August, 1920, and has been kept wound and rated since.

Batteries, Power Supply, &c.—The necessary current for the Time Service has been supplied by accumulator batteries, charged as found necessary from the alternating mains of the China Light and Power Co., Ld., by a rotary converter. Two batteries of 10 Hart cells of the S. G. 9-plate pattern were set up in May to replace the old Tudor Battery, all the cells of which had become unserviceable except two. These were used for the filament of the valve of the wireless receiving set. A battery of 30 Pritchett cells was set up at the same time to supply high tension current to the valve.

Since the re-wiring mentioned last year, and the acquisition of sufficient battery power, the internal Time Service has been extremely satisfactory.

The occasional trouble with the Time Ball, arising from earth leakage or want of adjustment of the releasing trigger, also appears to have been overcome. There has been no failure since September 27.

IX.—Upper Air Research.

When on leave of absence in England the Director was requested to confer with the Air Ministry with a view to advising the Hongkong Government what it was necessary to do on the meteorological side to assist aviation in the Colony.

The Director visited the upper air research stations at Benson and South Farnborough, and also conferred with the Director of the London Meteorological Office and the Superintendent of Instruments several times.

Facilities for obtaining the necessary information were courteously accorded by Sir Napier Shaw and the Superintendents of the above Departments, to whom the thanks of this government are due.

As result of his enquiries the Director recommended the purchase of the following outfit :—

Two theodolites.
Ten Dines Meteorographs.
One Microscope for measuring meteorograms.
Ten hygrometers.
400 Pilot balloons.
Two Mannheim slide rules.
Calibrating outfit for meteorographs.

The Hongkong Government however were unable to sanction the appointment of the Professional Assistant and Mechanic necessary for carrying out a programme of upper air research with the above instruments, and requested the Director to amend his recommendations accordingly. This was done by omitting the meteorographs, microscope and calibrating outfit. The remaining items were sanctioned, and ordered through the London Meteorological Office in August. They have not yet been received.

Sir Napier Shaw wrote to the Director as follows :—

> I cannot find that there is any immediate prospect of developing air routes on the line of which Hongkong will lie. It is quite clear that if routes were to be developed between Japan and Australia or between India and Japan, Hongkong would be a centre of information of the most vital importance, but I am not aware that projects of that kind are being actively prosecuted. We have therefore to deal with the general meteorological importance of the position of Hongkong and of that there can be no question, and what will be useful for aviation when it materialises will be in the meantime useful for the study of cyclones and other atmospheric visitations of Hongkong.
>
> While therefore I cannot say that aviators will forthwith claim your assistance, meteorologists will look to you as the natural centre of information for the region between Calcutta and the Philippines and between the equator and latitude 50°.
>
> It is very desirable that you should be equipped with means of exploration of the upper air and provided with facilities for acquiring information from a network of stations in the region specified.

X.—Miscellaneous.

Seismograph Installation.—When on leave of absence the Director visited the Oxford University Observatory to confer with Professor Turner, Chairman of the Seismological Committee of the British Association for the Advancement of Science, on the subject of a seismograph outfit for Hongkong.

A Milne-Shaw machine with North and East components, and a smoked paper machine for visual observations were decided upon. The latter arrived in Hongkong on January 25, 1921.

The Director visited Mr. J. J. Shaw's Seismological Observatory at Birmingham and had the opportunity of seeing one of his seismographs dismounted and re-assembled. He also discussed several points in connection with the construction and maintenance of a two component outfit for Hongkong.

Mr. Shaw has improved the Milne Seismograph by electromagnetic damping and by magnifying the movements of the boom (shorter than the Standard Milne boom) by reflecting a beam of light from an exceedingly light, finely pivoted mirror of half-metre focus, coupled to the end of the boom by an equally light, ingenious, and almost frictionless device. Improved calibrating and adjusting arrangements are also provided.

Staff.—No change occurred in the European Staff during the year. During the absence on leave of the Director, from March 2 to December 4, Mr. C. W. Jeffries, the Chief Assistant, acted as Director and Mr. B. D. Evans, First Assistant, acted as Chief Assistant.

Leong Kwok Hoon, 5th grade telegraphist, resigned on May 31, and was replaced by Ko Chuck Shan, who, being found unsuited to the post, was superseded by Ip Chun Woo on August 1.

Chan Iu Fong was promoted to the post of IVth grade telegraphist at the Post Office on December 9 and was replaced by Ng Hung Kui on December 24.

Expenditure.—The annual expenditure on the Observatory for the past ten years is as follows:—

Year.	Total Expenditure.	Increase.	Decrease.
	$ c.	$ c.	$ c.
1911	23 353.02	1,565.47	.....
1912	22,595.08	.....	757.94
1913	24.255.49	1,660.41	.....
1914	25 398.31	1,142.82	.....
1915	23,233.12	.....	2,165.19
1916	21,977.78	.....	1,255.34
1917	26.890.50	4,192.72	.....
1918	20,028.24	.....	6,862.26
1919	23,450.57	3.422.33	.....
1920	25,965.66	2,515.09	.....

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T. F. Claxton,
Director.

1921, February 18.


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